Reference # 5

ATMOSPHERIC TRANSPORT OF LEAD FROM MILL TAILINGS IN THE TRI-STATE DISTRICT

by

Guy Neenan

B.A., University of Missouri, Columbia 1971

In partial fulfillment of the requirements for the degree of Master of Science in Environmental Health Science from the University of Kansas School of Engineering, Department of Civil Engineering, Division of Environmental Health

Presented November 11, 1982

Prepared with the supervision of Professors Dennis Lane, Carl Burkhead, and George Traiger

REFERENCES

1. Gibson, A.M., "Wilderness Bonanza." University of Oklahoma Press, Norman (1972).

2. Schoolcraft, H.R., "A View of the Lead Mines of Missouri." Reprint of 1819 edition, Arno (1971).

3. Neenan, G., "Reclamation of Lead and Zinc Mining Wastes." Literature review for Civil Engineering Course 878 (1981).

4. Chepil, W. and Woodruff, N., "The Physics of Wind Erosion and its Control." Advances in Agronomy, A.G. Norman, editor, Academic Press, New York 15,211 (1963).

5. Woodruff, N. and Siddoway, F., "A Wind Erosion Equasion." Soil Science Society Proceedings 602 (1965).

6. Bagnold, R.A., "The Physics of Blown Sand and Desert Dunes." Methune, London (1941).

7. Wischmeier, W.H., editor, "Soil Erosion: Prediction and Control." Soil Conservation Society of America, AnKeny, Iowa (1976).

8. Chepil, W.S., "Dynamics of Wind Erosion." Soil Science 60, 305 (1945).

9. Gillette, D.A., Blifford, I., and Fryrear, D., "The Influence of Wind Velocity on the Size Distributions of Aerosols Generated by the Wind Erosion of Soils." Journ. of Geophysical Research 79, 4068 (1974).

10. Cowherd, C., "Emission Factors for Wind Erosion of Exposed Aggregates at Surface Coal Mines." Presented at the 75th Meeting of the Air Pollution Control Association, June 1982, Midwest Research Institute, Kansas City, MO, monograph 82-15.5 (1982).

11. Guerin, J., "Performance Evaluation of a Haul Road Dust Suppressant." Midwest Research Institute Project 2036-L (1980).

12. Ter Haar, G. and Bayard, M., "Composition of Airborne Lead Particles." Nature 232, 553 (1971).

13. "Lead in the Human Environment," National Research Council, National Academy of Sciences, Washington, D.C. (1980).

14. Irwin, J.C., "Survey of Environmental Contaminants Near Galena, Kansas"." Kansas Department of Health (1971).

15. Lagerwerff, J. and Brower, D., "Source Determination of Heavy Metal Contaminants in the Soil of a Mine and Smelter Area." Trace Substances in Environmental Health, Hemphill, D., editor, University of Missouri Press, Columbia IX, 207 (1975).

16. Mitchell, D.G., and Aldous, K., "Lead Content of Foodstuffs." Environmental Health Perspectives 7,59 (1974).

17. Nriagu, J.O., editor, "The Biogeochemistry of Lead in the Environment." Elsevier-North-Holland, New York (1978).

18. Chow, T.J., "Lead in Natural Waters," in reference 17.

19. Posner, H., Damstra, T., and Nriagu, J., "Human Health Effects of Lead," in Reference 17.

20. Mahaffey, K.R. "Environmental Exposure to Lead," in reference 17.

21. Wiener, G., "Varying Psychological Sequelae of Lead Absorption in Children -- A Review." Public Health Reports 85, 19 (1970).

22. Silbergeld, E.K. and Goldberg, A.M., "Hyperactivity: A Lead-Induced Behavior Disorder." Environmental Health Perspectives 7, 227 (1974).

23. Carrol, P., Silbergeld, E.K., and Goldberg, A.M., "Alteration of Central Cholinergic Function by Chronic Lead Acetate Exposure." Biochemical Pharmacology 26, 397 (1977).

24. Silbergeld, E.K. and Adler, H.S., "Subcellular Mechanisms of Lead Neurotoxicity." Brain Research 148, 451 (1978).

25. Silbergeld, E.K.;Miller, L.P.; Kennedy, S.;and Eng, N.; "Lead, GABA, and Seizures: Effects of Subencephalopathic Lead Exposure on Seizure Sensitivity, and GABAergic Function." Environmental Research 19, 371 (1979).

26. Needleman, H.L.; Gunnoe, C.; Leviton, A.; et al., "Deficits in Psychologic and Classroom Performance of Children with Elevated Dentine Lead Levels." New Engl. Journ. Medicine 300, 689 (1979).

27. Hattis, D.R.;Goble, R.; and Ashford, N.; "Airborne lead: A Clearcut Case of Differential Protection." Environment, 24, 15 (1982).

28. Lagerwerff, J.V. and Brower, D.L., "Effect of a Smelter on the Agricultural Conditions in the Surrounding Environment." Trace Substances in Environmental Health VIII, 203 (1974).

skewed from pile to pile, and from different levels within the same pile. Typically, coarser particles cover the surface 5 mm of a pile with finer particles underlying. Piles are well drained in general and are not compressible. Surface crusting, which would stabilize the piles from weathering does not occur.

Perhaps the most important feature of chat material which makes it an interminable environmental nuisance is its zinc content. Zinc is phytotoxic and vegetation is unable to establish a turf which would reduce wind and water erosion. The problems of revegetation of chat material were discussed in a previous report (3). Conclusions from this report are listed in Table 2.

1.	Surfaces should be graded to slopes no greater than 16%.
2.	Surfaces should be neutralized with lime or sewage sludge to reduce pH and heavy metal transport.
3.	Surfaces should be assayed for pH, heavy metal concentrations, and grain sizes.
4.	Topsoil could be used only if a minimum of 45 cm depth is applied.
5.	Sewage sludge or locally derived industrial materials, even if inert, could be useful amendments.
6.	Less fertile amendments such as shale, clay, or carbonate-rich fill are superior to enriched amendments because they reduce root penetration depth.
7.	Native, shallow-rooting, and tolerant grass species are better choices for reseeding.
8.	There is a need for research about legume survival under high heavy metal stress.
9.	Boron addition would be critical for legume survival.
10.	Vegetation would require maintenance by reseeding and by nitrogen and phosphate fertilization.
11.	Vegetation would be unsuitable for livestock forage.
12.	Revegetation efforts would be economically feasible only at high priority sites, or for research-demonstration plots.

Table 2. List of conclusions from study of lead-zinc tailings reclamation by revegetation. Reference 3.